

SECTION 1007 - RETROREFLECTIVE SHEETING: of the Standard Specifications is revised to read:

1007-1 General Requirements:

Retroreflective sheeting shall consist of a retroreflective system having a smooth outer surface. The sheeting shall have a pre-coated adhesive on the back side protected by an easily removable liner, except for self-supporting products having a Class V backing, such as roll-up signs and some types of traffic cone collars. Sheeting shall conform to criteria listed in ASTM D 4956-04 for the applicable type and class, unless otherwise specified. All references herein to ASTM D 4956 shall refer to ASTM D 4956-04.

Only those retroreflective sheeting, inks, and film products that are currently shown in the Department's Approved Product List (APL) shall be used. Copies of the APL are available on the internet at <http://www.dot.state.az.us/ABOUT/atrc/apl.htm>.

A Certificate of Compliance, conforming to the requirements of Subsection 106.05, shall be submitted. The Certificate of Compliance shall identify the retroreflective sheeting type, backing class, make of sheeting, inks, and film intended for use in all manufactured devices, including signs, channeling devices, mileposts, object markers, guard rail markers, delineators and reference markers. The Engineer may accept all materials based on the certification or may require the contractor to furnish additional information or laboratory test results. Additionally, the Engineer may perform measurements on materials to determine their compliance with these specifications. Signs and other devices that have sheeting, inks or films that do not meet these requirements shall be rejected and shall be replaced at no additional cost to the Department.

1007-2 Material Types:

Table 1007-1 lists the sheeting alternatives that are acceptable for each category of use, where Type I is the lowest and Type X is the highest sheeting type. Type VI is a flexible sheeting material suitable for use with roll-up signs. The type of sheeting to be used in any given application will be called out on the project plans. If no sheeting type is specified, the default selection shall be the lowest type of sheeting shown in Table 1007-1 for the specified use. For applications where more than one sheeting type is allowed, the contractor may use a higher grade of sheeting than specified at no additional cost to the Department.

TABLE 1007-1							
SIGN TYPE OR APPLICATION	TYPE OF SHEETING						
	I	III/IV	V	VI	VIII	IX	X
Warning Signs (Fluorescent)(30 sq. ft. or smaller)					X	X	X
Warning Signs (greater than 30 sq. ft.)		X			X	X	X

Regulatory Signs (White)		X			X	X	X
Regulatory Signs (Red)					X	X	X
Guide Sign-Backgrounds		X			X	X	X
Direct Applied Characters and Shields on Guide Signs					X	X	X
Demountable Characters and Shields on Guide Signs					X	X	X
Route Marker Signs and Auxiliaries (stand-alone)		X			X	X	X
Orange Work Zone Signs (Fluorescent)				X	X	X	X
Orange Work Zone Signs (Roll-up)				X			
Barricades, Channelizers and other Work Zone devices		X			X	X	X
Milepost Markers		X			X	X	X
Object Markers, Guard Rail Markers, and Delineators			X		X	X	X
Object Markers for Guard Rail End Treatments, and Impact Attenuators (Fluorescent)					X	X	X
Adopt-A-Highway Signs and Logo Signs	X						

Type II and VII sheeting will not be allowed. Products or applications using Type II or Type VII sheeting will not be accepted for installation or payment.

Materials used for a particular application shall be of the same ASTM type, manufacturer, and product for all signs of the same type in the project.

Opaque films used with sheeting shall be either acrylic or vinyl type films. Vinyl film shall be used with Type I sheeting, and acrylic film shall be used for all other sheeting types.

Direct-applied and demountable black characters shall be non-reflective.

1007-3 Visual Appearance, Luminance and Color Requirements:

Except as specified herein, the color of the sheeting, ink or film shall conform to the requirements of the ADOT Manual of Approved Signs, and the Manual on Uniform Traffic Control Devices (MUTCD), and the plans.

All warning signs with an area of 30 square feet or smaller with yellow backgrounds shall use fluorescent yellow sheeting.

All work zone signs with orange backgrounds shall use fluorescent retroreflective orange sheeting, except that non-reflective sign materials may be used for temporary work zone signs where the signs will be clearly visible under available natural light.

All sheeting, inks and film used shall be uniformly colored so that there is no visual variation in their appearance on the same sign, or from sign to sign of the same colors.

Standard colors specified for sheeting, processing inks, and films shall, as applicable, match visually and be within the color tolerance limits required by Highway Tolerance Charts

issued by the Federal Highway Administration. Additionally, the Luminance Factor (Daytime Luminance) and Color Specification Limits (Daytime) shall conform to the applicable requirements of ASTM D 4956.

In addition to the specified luminance and color requirements, fluorescent orange sheeting shall have the capacity to effectively fluoresce outdoors under low light conditions. For all applications requiring fluorescent orange sheeting, the contractor shall provide a letter to the Engineer from the manufacturer certifying that the sheeting to be used is fluorescent.

1007-4 Coefficient of Retroreflection:

The coefficient of retroreflection shall meet the minimum requirements of ASTM D 4956 for the type of retroreflective sheeting specified.

All black opaque films shall have a maximum coefficient of retroreflection of 1.0 or less at an observation angle of 0.2 degrees and entrance angle of -4.0 degrees.

1007-5 Color Processing:

Transparent and opaque inks used for post or pre-screen printing of signs shall be of a type and quality specified by the sheeting manufacturer, and shall conform to the applicable requirements of the MUTCD and the Federal Highway Administration for traffic signs. The inks shall be applied in a manner, and with equipment, that is consistent with the ink manufacturer's recommendations. Additionally, the signs produced shall have a uniform legend of consistent stroke width and sharply defined edges, without blemishes that would negatively impact appearance, color or required retroreflectivity.

For sheeting applications using black ink, the maximum coefficient of retroreflection shall be 1.0 or less at an observation angle of 0.2 degrees and entrance angle of -4.0 degrees.

1007-6 Adhesive:

Reflective Sheeting and film adhesives shall be either Class I or II as specified in ASTM D 4956 and as modified herein.

Pressure sensitive adhesive shall be an aggressive tack type that requires no heat, solvent or other pre-application preparation of the sheeting or film for its adhesion to clean aluminum, plywood, or reflective sheeting surfaces. Pretreatment of plastic surfaces shall be done as recommended by the sheeting manufacturer.

Heat-activated adhesives shall allow positioning under normal working conditions and temperatures without damage to the materials or application surface. This type of adhesive shall be activated by applying heat in excess of 150 degrees F to the material using a heat vacuum process. No pre-treatment of the heat activated adhesive shall be necessary.

The adhesive shall form a tight weatherproof durable bond that shall endure under all weather conditions for the required time of durability for that material. During this period the

material shall remain bonded to its surface without discoloration, cracking, crazing, peeling, blistering, dimensional change or alignment change.

1007-7 Weather Testing:

For the evaluation of sign sheeting products the Department has adopted a desert environment, 45 degree, south-facing outdoor acceleration test method. Sheetings will be tested for the time periods specified in Subsection 1007-8. The Department's test method will be considered to produce a two to one time-acceleration ratio for equivalent vertical exposure.

1007-8 Durability Requirements:

Sheeting stability will be determined using a durability rating which shall be equal to twice the testing periods listed below. Sheeting must be warranted by the manufacturer against the defects listed below for a period equal to the specified durability rating for each type of sheeting product. Only those sheeting products which provide the specified warranty will be acceptable.

Type III/IV, VIII, IX, and X sheeting shall be weather-tested, as specified above, for a period of 60 months. Type I sheeting used on permanent signs shall be weather-tested for a period of 42 months. Orange colored sheeting used for construction zone signing, barricades, and channeling devices shall be weather-tested for a period of 18 months. All other sheeting shall be weather-tested for a period of 30 months. In all cases the related inks and films shall be tested along with the respective sheeting, and shall be subject to the same durability requirements as the sheeting.

Type III/IV, VIII, IX, and X sheeting, related inks and films shall have a minimum ten year durability rating. Type I sign sheeting and related inks and films used on this sheeting shall have a durability rating of seven years. All orange sign sheeting shall have a minimum durability rating of three years. All other sheeting, films, and inks shall have a minimum durability rating of five years.

After weather testing for the periods specified above, sheeting and related inks and films shall show no significant degradation or reduced performance. Unacceptable degrees of degradation and reduced performance are as listed below:

- (1) Bubbles, wrinkles, cracks or breaks on any portion of the applied materials greater than three inches in length that result in a negative appearance or concerns of additional degradation.
- (2) Significant shrinkage that causes the material to curl or to pull away from the background.
- (3) Significant delaminating of any material or layer (sheeting to substrate, sheeting to sheeting, sheeting to film, ink to sheeting, film to sheeting or film to film).

- (4) Significant visible discoloration, including clouding or chalking.
- (5) A loss of transparency of any transparent sheeting, ink or film.
- (6) A loss in opaqueness of any opaque ink or film.
- (7) Significant cracking, blistering, ripping, flaking, curling or chipping of any sheeting, ink or film.
- (8) A loss of nighttime retroreflectivity as observed at night under normal conditions, or as defined and measured with a portable retroreflectometer at an observation angle of 0.2 degrees and entrance angle of -4.0 degrees. The measured coefficient of retroreflection shall be consistent with what would be expected of the type of material being measured, normal manufacturing variations, the time that the material has been in the field, and FHWA requirements.

Those sheeting products which have been evaluated for the time periods specified above using the Department's own testing and evaluation program, and that have been shown to meet the durability requirements listed herein, are included on the Approved Products List.

Manufacturer's guarantees or warranties on all traffic sign material shall be transferred to the Department upon completion and acceptance of the project in accordance with the requirements of Subsection 106.13.

1007-9 Application:

The sheeting, inks, clear coats (if required), and films shall be applied as specified by the manufacturer. The applied sheeting or film shall not have bubbles, wrinkles or foreign materials beneath the reflective sheeting, ink or film.